REF
354.
353
GEI

b2472452x

SOMERVILLE PUBLIC LIBRARY
3 1155 00628 7747

GEI Consultants

September 21, 2006
Project 04516

Geotechnical
Environmental and
Water Resources
Engineering

RECEIVED
SEP 21 2006
DEP
NORTHEAST REGIONAL OFFICE

Ms. Irene M. Dale
Environmental Engineer
Bureau of Waste Site Cleanup
Department of Environmental Protection
205B Lowell Street
Wilmington, MA 01887

Dear Ms. Dale:

Re: Retraction of Imminent Hazard Notification
50 Tufts Street
Somerville, Massachusetts
RTN: 3-0026114

REF
354.
353
GEI

On behalf of UniFirst Corporation of Wilmington, Massachusetts, we are retracting the August 1, 2006 notification of a potential Imminent Hazard (IH) associated with the measurement of tetrachloroethylene (PCE) in indoor air at 23 and 27 Tufts Street in Somerville, Massachusetts. The site location is shown on Fig. 1 and the resident locations are shown on Fig. 2. The original Massachusetts Department of Environmental Protection (DEP) Release Notification Form (RNF; BWSC-103) is being submitted with this retraction and a copy of the form is in Attachment A.

Background

Chlorinated VOCs have been detected in groundwater samples collected from monitoring wells located east of 50 Tufts Street (the Property) across Tufts Street. In 2005, DEP conducted indoor air testing for PCE and other VOCs at residences located across from 50 Tufts Street including 9, 11/13, 17, 19, 23, 25 and 27 Tufts Street. DEP sent a letter to each homeowner summarizing the results of its testing and reported that the PCE detected during the indoor air testing was below DEP's "threshold limit" for "significant risk of harm to health over a short period of time" and "below the levels DEP typically finds in homes."

UniFirst initiated a quarterly indoor air monitoring program at the same homes along Tufts Street in March 2006, and collected a second round of indoor air samples in June 2006. In June 2006, GEI attempted to obtain access to collect indoor air samples from the basement and first floor living areas of the residences at 9, 11/13, 17, 19, 23, 25 and 27 Tufts Street. GEI collected samples on June 28 and 29, 2006 at 11/13, 19, 23 and 27 Tufts Street; however, we were unable to obtain access at that time to 9, 17 and 25 Tufts Street.

Higher concentrations of PCE in indoor air were detected in the first floors at 11/13, 19, 23, and 27 Tufts Street and in the basements at 11/13, 23 and 27 Tufts Street in the June 2006 samples than those detected in March 2006. At 11/13 and 19 Tufts Street, the differences in concentrations from March

2006 to June 2006 were not substantial. However, PCE concentrations in the basement samples of 23 and 27 Tufts Street and the first floor sample at 23 Tufts Street were significantly higher than previously measured.

Imminent Hazard Evaluation

UniFirst engaged AMEC Earth & Environmental of Westford, Massachusetts to evaluate the potential for an Imminent Hazard based on the indoor air concentrations measured in June 2006. We are submitting a copy of AMEC's report, "Assessment of Risk 'For a Short Period of Time', UniFirst Corporation, 50 Tufts Street Site, Somerville, Massachusetts," dated September 17, 2006 as Attachment B to this letter.

AMEC evaluated the noncarcinogenic and carcinogenic risks at each residence based on a five-year exposure to the indoor air concentrations measured in June 2006. AMEC's approach to this initial Imminent Hazard Evaluation was very conservative, since it assumed exposure for five years to the maximum concentration detected, and not an average of all measured concentrations. As AMEC states in its report, pending the results of confirmatory sampling, and in the context of assessing the potential applicability of the reporting requirements under 310 CMR 40.0311(7), AMEC assumed that receptors might be exposed to the June 2006 concentrations for a full five-year period. The initial assumption that receptors would be exposed to the June 2006 concentrations daily for five full years was not, in fact, borne out by the confirmatory sampling.

An Imminent Hazard exists if the estimated Excess Lifetime Cancer Risk exceeds 1/100,000. For five years (without any remedial actions), the estimated ELCR for the residence at 23 Tufts Street was greater than 1/100,000 and equal to 1/100,000 for 27 Tufts Street. The Hazard Index for both properties was less than 10.

Imminent Hazard Reporting

Based on an ELCR greater than 1/100,000 at 23 Tufts Street, Mr. Brian Keegan, Senior Environmental Manager at UniFirst and Ms. Ileen Gladstone, LSP of GEI reported the potential for an Imminent Hazard to Mr. Kyle McAfee of the DEP on August 1, 2006. DEP assigned RTN 3-0026114 to the release. In addition to further evaluating conditions at 23 Tufts Street, UniFirst proposed to also evaluate conditions at 27 Tufts Street.

Sampling Results

GEI attempted to obtain access to collect indoor air samples from the basement and first floor living areas of the residences at 9, 11/13, 17, 19, 23, 25 and 27 Tufts Street. GEI collected samples on June 28 and 29, 2006, at 11/13, 19, 23 and 27 Tufts Street, but we were unable to obtain access at that time to sample at 9, 17 and 25 Tufts Street. We subsequently sampled 9 Tufts Street on July 24, 2006, and 25 Tufts Street on August 1, 2006. After numerous attempts to contact the residents at 17 Tufts Street, we were unable to obtain access to that residence during the 2006 second quarter sampling round.

GEI collected a second round of indoor air samples at 23 and 27 Tufts Street on August 3, 2006. The results are summarized on Table 1 and the laboratory data reports are presented in the Interim IRA Status Report No. 2 and IRA Modification (RTN 3-23246) to be submitted to DEP by September 30,

2006 shortly to DEP concurrently with this Retraction of Imminent Hazard Retraction. PCE concentrations detected in samples collected from 23 and 27 Tufts Street in August 2006 were significantly lower than those detected in samples collected in June 2006.

Updated Imminent Hazard Evaluation

AMEC updated the Imminent Hazard Evaluation for 23 and 27 Tufts Street incorporating the August data. AMEC also evaluated if the conditions at 9 and 25 Tufts Street pose an Imminent Hazard. AMEC evaluated the noncarcinogenic and carcinogenic risks for the residents based on exposure to the average indoor air concentrations of all data collected at each residence, not just the August round of sampling results. Based on the existing data, AMEC's approach to this updated Imminent Hazard Evaluation is representative of the potential fluctuations in VOC concentrations at each residence over 5 years. This approach is conservative, because it assumes that the June 2006 data contributed to potential receptor exposures equally compared to the other three data sets, even though, when compared to other sampling results from the same locations, the June 2006 data are anomalous.

An Imminent Hazard exists if the estimated ELCR exceeds 1/100,000. For five years (without any remedial actions), the estimated ELCR for the residence at 23 Tufts Street was equal to 1/100,000. For 9, 25 and 27 Tufts Street, the ELCR is less than 1/100,000. The Hazard Index for all properties is less than 10. Consequently, an Imminent Hazard does not exist and did not exist at any of the residences evaluated along Tufts Street, and it is appropriate to retract the Imminent Hazard notification made on August 1, 2006.

Additional Response Actions

Immediate Response Actions are currently being conducted at the site under RTN 3-23246. In connection with that Release Tracking Number, GEI is offering to install a carbon filter air purifier in each basement of the residences evaluated along Tufts Street while additional investigation proceeds. The air purifiers will be installed in connection with the ongoing IRA activities for RTN 3-23246 and concurrent with the submittal of this Imminent Hazard Retraction letter. An IRA Plan Modification is being submitted under separate cover.

If you need any additional information, please feel free to contact me at 781.721.4012 or at igladstone@geiconsultants.com.

Sincerely,

GEI CONSULTANTS, INC.

Ileen S. Gladstone, P.E., LSP
Vice President

ISG:rr

N:\04516\#Final\04516\IHE\IH Retraction 9-21-06.DOC

c: Brian Keegan, UniFirst Corporation
Stephen Aquilino, UniFirst Corporation
Vithal Despande, City of Somerville

GEI Consultants

Geotechnical
Environmental and
Water Resources
Engineering

Table 1
Chemical Testing Results - Indoor Air Samples
50 Tufts Street
Somerville, MA

Sample Location:				9 Tufts St., basement						9 Tufts St., 1st floor		9 Tufts St., 1st floor, left apartment				9 Tufts St., 1st floor, right apartment			
Sample Name:				IA-6		045160-9 Tufts-BR		045160-9 Tufts-BR		IA-5		045160-9 Tufts-1L		045160-9 Tufts-1L		045160-9 Tufts-1R		045160-9 Tufts-1R	
Sample Date:				2/23/05		3/23/06		7/24/06		2/23/05		3/23/06		7/24/06		3/23/06		7/24/06	
Collected By:				Shaw Environmental		GEI Consultants, Inc.		GEI Consultants, Inc.		Shaw Environmental		GEI Consultants, Inc.		GEI Consultants, Inc.		GEI Consultants, Inc.		GEI Consultants, Inc.	
Units:				ug/m^3	ppbV	ug/m^3	ppbV	ug/m^3	ppbV	ug/m^3	ppbV	ug/m^3	ppbV	ug/m^3	ppbV	ug/m^3	ppbV	ug/m^3	ppbV
Analyte	Method	DEP Background Concentrations in Indoor Air																	
		ug/m^3	ppbV																
Volatile Organic Compounds (VOCs)	TO-15																		
Carbon tetrachloride		1	0.16	< 1.3	< 0.20	< 1.3	< 0.20	< 1.3	< 0.20	< 1.3	< 0.20	< 1.3	< 0.20	< 1.3	< 0.20	< 1.3	< 0.20	< 1.3	< 0.20
Chloroform		3	0.6	0.54 J	0.11 J	1.3	0.26	1.2	0.24	1.2	0.25	0.78 J	0.16 J	0.88 J	0.18 J	< 0.98	< 0.20	2.3	0.47
Chloromethane		NS	NS	0.91	0.44	1.1 L	0.53 L	0.95	0.46	1.0	0.49	1.4 L	0.69 L	1	0.49	1.4 L	0.69 L	1.1	0.55
1,2-Dichloroethane		NS	NS	< 0.81	< 0.20	< 0.81	< 0.20	< 0.81	< 0.20	< 0.81	< 0.20	< 0.81	< 0.20	< 0.81	< 0.20	< 0.81	< 0.20	< 0.81	< 0.20
Methylene chloride		10	2.83	0.56 J	0.16 J	< 1.9 M	< 0.55 M	11	3.1	0.59 J	0.17 J	< 1.8 M	< 0.52 M	< 4.2 M	< 1.2 M	< 1.3 M	< 0.36 M	< 6.8 M	< 1.9 M
Tetrachloroethylene (PCE)		11	1.6	1.3 J	0.19 J	2.4	0.35	3.1	0.45	1.8	0.27	< 1.4	< 0.20	1.2 J	0.18 J	0.95 J	0.14 J	2	0.29
1,1,1-Trichloroethane		30	5.41	< 1.1	< 0.20	< 1.1	< 0.20	< 1.1	< 0.20	< 1.1	< 0.20	< 1.1	< 0.20	< 1.1	< 0.20	< 1.1	< 0.20	< 1.1	< 0.20
Trichloroethylene (TCE)		5	0.92	< 1.1	< 0.20	< 1.1	< 0.20	< 1.1	< 0.20	< 1.1	< 0.20	< 1.1	< 0.20	< 1.1	< 0.20	< 1.1	< 0.20	< 1.1	< 0.20

General Notes:
1. Analytes detected in at least one sample are reported here. For a complete list of analytes see the laboratory data sheets.
2. ug/m^3 = micrograms per cubic meter.
3. ppbV = parts per billion by volume.
4. DEP Background Concentrations obtained from MADEP BWSC NERO Memorandum "Latest Revision of the Indoor Air Contaminants Comparison Table," dated August 2002.
5. NS = No DEP Background Concentration has been established for this compound.
6. "<" = The analyte was not detected at a concentration above the specified laboratory reporting limit.
7. Results in bold exceed the DEP Background Concentration in Indoor Air.

Qualifying Notes:
J The reported result is below the laboratory reporting limit and is estimated.
L The reported result is estimated because the calculated relative percent difference (RPD) between a sample and the matrix duplicate was above the quality control limit specified in the Quality Assurance Project Plan (QAPP).
M The reporting limit is elevated due to a detection of the analyte in a method blank sample, trip blank sample, or both.

Table 1
Chemical Testing Results - Indoor Air Samples
50 Tufts Street
Somerville, MA

		Sample Location:		23 Tufts St., basement								23 Tufts St., 1st floor							
		Sample Name:		IA-8		045160-23 Tufts-B		045160-23 Tufts-B		045160-23 Tufts-B		IA-7		045160-23 Tufts-1		045160-23 Tufts-1		045160-23 Tufts-1	
		Sample Date:		2/23/05		3/24/06		6/28/06		8/3/06		2/23/05		3/24/06		6/28/06		8/3/06	
		Collected By:		Shaw Environmental		GEI Consultants, Inc.		GEI Consultants, Inc.		GEI Consultants, Inc.		Shaw Environmental		GEI Consultants, Inc.		GEI Consultants, Inc.		GEI Consultants, Inc.	
		Units:		ug/m³	ppbV	ug/m³	ppbV	ug/m³	ppbV	ug/m³	ppbV	ug/m³	ppbV	ug/m³	ppbV	ug/m³	ppbV	ug/m³	ppbV
Analyte	Method	DEP Background Concentrations in Indoor Air																	
		ug/m³	ppbV																
Volatile Organic Compounds (VOCs)	TO-15																		
Carbon tetrachloride		1	0.16	< 1.3	< 0.20	< 1.3	< 0.20	< 1.3	< 0.20	0.69 J	0.11 J	< 1.3	< 0.20	< 1.3	< 0.20	0.94 J	0.15 J	0.69 J	0.11 J
Chloroform		3	0.6	0.88 J	0.18 J	< 0.98	< 0.20	**3.7**	**0.76**	NT	NT	0.63 J	0.13 J	< 0.98	< 0.20	**13**	**2.7**	NT	NT
Chloromethane		NS	NS	1.1	0.54	1.6 L	0.79 L	1.9	0.91	NT	NT	0.97	0.47	1.7 L	0.82 L	1.6	0.78	NT	NT
1,2-Dichloroethane		NS	NS	< 0.81	< 0.20	< 0.81	< 0.20	< 0.81	< 0.20	< 0.81	< 0.20	< 0.81	< 0.20	< 0.81	< 0.20	< 0.81	< 0.20	< 0.81	< 0.20
Methylene chloride		10	2.83	0.49 J	0.14 J	< 2.0 M	< 0.57 M	< 2.4 M	< 0.7 M	NT	NT	0.52 J	0.15 J	< 2.7 M	< 0.77 M	**396 L**	**114 L**	NT	NT
Tetrachloroethylene (PCE)		11	1.6	**2.3**	**0.34**	2.8	0.42	**125**	**18.5**	10	1.5	1.6	0.23	< 1.4	< 0.20	**94.9**	**14.0**	9.5	1.4
1,1,1-Trichloroethane		30	5.41	< 1.1	< 0.20	< 1.1	< 0.20	1.5	0.28	0.60 J	0.11 J	< 1.1	< 0.20	< 1.1	< 0.20	1.0 J	0.19 J	< 1.1	< 0.20
Trichloroethylene (TCE)		5	0.92	< 1.1	< 0.20	< 1.1	< 0.20	1.0 J	0.19 J	< 1.1	< 0.20	< 1.1	< 0.20	< 1.1	< 0.20	0.64 J	0.12 J	< 1.1	< 0.20

General Notes:
1. Analytes detected in at least one sample are reported here. For a complete list of analytes see the laboratory data sheets.
2. ug/m³ = micrograms per cubic meter.
3. ppbV = parts per billion by volume.
4. DEP Background Concentrations obtained from MADEP BWSC NERO Memorandum "Latest Revision of the Indoor Air Contaminants Comparison Table," dated August 2002.
5. NS = No DEP Background Concentration has been established for this compound.
6. "<" = The analyte was not detected at a concentration above the specified laboratory reporting limit.
7. Results in bold exceed the DEP Background Concentration in Indoor Air.

Qualifying Notes:
J The reported result is below the laboratory reporting limit and is estimated.
L The reported result is estimated because the calculated relative percent difference (RPD) between a sample and the matrix duplicate was above the quality control limit specified in the Quality Assurance Project Plan (QAPP).
M The reporting limit is elevated due to a detection of the analyte in a method blank sample, trip blank sample, or both.

Table 1
Chemical Testing Results - Indoor Air Samples
50 Tufts Street
Somerville, MA

				Sample Location:	25 Tufts St., basement						25 Tufts St., 1st floor					
				Sample Name:	IA-4		045160-25 Tufts-B		045160-25 Tufts-B		IA-3		045160-25 Tufts-1		045160-25 Tufts-1	
				Sample Date:	2/23/05		3/23/06		8/1/06		2/23/05		3/23/06		8/1/06	
				Collected By:	Shaw Environmental		GEI Consultants, Inc.		GEI Consultants, Inc.		Shaw Environmental		GEI Consultants, Inc.		GEI Consultants, Inc.	
				Units:	ug/m^3	ppbV	ug/m^3	ppbV	ug/m^3	ppbV	ug/m^3	ppbV	ug/m^3	ppbV	ug/m^3	ppbV
Analyte	Method	DEP Background Concentrations in Indoor Air														
		ug/m^3	ppbV													
Volatile Organic Compounds (VOCs)	TO-15															
Carbon tetrachloride		1	0.16		< 1.3	< 0.20	< 1.3	< 0.20	< 1.3	< 0.20	< 1.3	< 0.20	< 1.3	< 0.20	< 1.3	< 0.20
Chloroform		3	0.6		< 0.98	< 0.20	< 0.98	< 0.20	NT	NT	2.0	0.4	< 0.98	< 0.20	NT	NT
Chloromethane		NS	NS		0.74	0.36	1.1 L	0.52 L	NT	NT	0.95	0.46	1.1 L	0.54 L	NT	NT
1,2-Dichloroethane		NS	NS		< 0.81	< 0.20	< 0.81	< 0.20	<0.81	<0.20	< 0.81	< 0.20	< 0.81	< 0.20	< 0.81	< 0.20
Methylene chloride		10	2.83		0.49 J	0.14 J	< 1.6 M	< 0.47 M	NT	NT	0.35 J	0.1 J	< 1.9 M	< 0.54 M	NT	NT
Tetrachloroethylene (PCE)		11	1.6		1.6	0.23	3.2	0.47	3.9	0.57	< 1.4	< 0.20	1.7	0.25	2	0.29
1,1,1-Trichloroethane		30	5.41		< 1.1	< 0.20	< 1.1	< 0.20	<1.1	<0.20	< 1.1	< 0.20	< 1.1	< 0.20	< 1.1	< 0.20
Trichloroethylene (TCE)		5	0.92		< 1.1	< 0.20	< 1.1	< 0.20	<1.1	<0.20	< 1.1	< 0.20	< 1.1	< 0.20	< 1.1	< 0.20

General Notes:
1. Analytes detected in at least one sample are reported here. For a complete list of analytes see the laboratory data sheets.
2. ug/m^3 = micrograms per cubic meter.
3. ppbV = parts per billion by volume.
4. DEP Background Concentrations obtained from MADEP BWSC NERO Memorandum "Latest Revision of the Indoor Air Contaminants Comparison Table," dated August 2002.
5. NS = No DEP Background Concentration has been established for this compound.
6. "<" = The analyte was not detected at a concentration above the specified laboratory reporting limit.
7. Results in bold exceed the DEP Background Concentration in Indoor Air.

Qualifying Notes:
J The reported result is below the laboratory reporting limit and is estimated.
L The reported result is estimated because the calculated relative percent difference (RPD) between a sample and the matrix duplicate was above the quality control limit specified in the Quality Assurance Project Plan (QAPP).
M The reporting limit is elevated due to a detection of the analyte in a method blank sample, trip blank sample, or both.

Table 1
Chemical Testing Results - Indoor Air Samples
50 Tufts Street
Somerville, MA

Sample Location:				27 Tufts St., basement								27 Tufts St., 1st floor							
Sample Name:				IA-10		045160-27 Tufts-B		045160-27 Tufts-B		045160-27 Tufts-B		IA-9		045160-27 Tufts-1		045160-27 Tufts-1		045160-27 Tufts-1	
Sample Date:				2/23/05		3/23/06		6/28/06		8/3/06		2/23/05		3/23/06		6/28/06		8/3/06	
Collected By:				Shaw Environmental		GEI Consultants, Inc.		GEI Consultants, Inc.		GEI Consultants, Inc.		Shaw Environmental		GEI Consultants, Inc.		GEI Consultants, Inc.		GEI Consultants, Inc.	
Units:				ug/m³	ppbV	ug/m³	ppbV	ug/m³	ppbV	ug/m³	ppbV	ug/m³	ppbV	ug/m³	ppbV	ug/m³	ppbV	ug/m³	ppbV
Analyte	Method	DEP Background Concentrations in Indoor Air																	
		ug/m³	ppbV																
Volatile Organic Compounds (VOCs)	TO-15																		
Carbon tetrachloride		1	0.16	< 1.3	< 0.20	< 1.3	< 0.20	0.69 J	0.11 J	< 1.3	<0.20	< 1.3	< 0.20	< 1.3	< 0.20	< 1.3	< 0.20	< 1.3	< 0.2
Chloroform		3	0.6	< 0.98	< 0.20	< 0.98	< 0.20	< 0.98	< 0.20	NT	NT	< 0.98	< 0.20	< 0.98	< 0.20	< 0.98	< 0.20	NT	NT
Chloromethane		NS	NS	0.6	0.29	2.9 L	1.4 L	1.3	0.65	NT	NT	1.2	0.59	110 L	53.5 L	1.6	0.79	NT	NT
1,2-Dichloroethane		NS	NS	< 0.81	< 0.20	< 0.81	< 0.20	< 0.81	< 0.20	< 0.81	<0.20	< 0.81	< 0.20	< 0.81	< 0.20	< 0.81	< 0.20	< 0.81	< 0.20
Methylene chloride		10	2.83	0.49 J	0.14 J	< 4.2 M	< 1.2 M	< 2.1 M	< 0.6 M	NT	NT	0.52 J	0.15 J	< 2.0 M	< 0.59 M	< 2.2 M	< 0.63 M	NT	NT
Tetrachloroethylene (PCE)		11	1.6	< 1.4	< 0.20	< 1.4	< 0.20	117	17.3	1.6	0.23	< 1.4	< 0.20	< 1.4	< 0.20	3.8	0.56	0.81 J	0.12 J
1,1,1-Trichloroethane		30	5.41	< 1.1	< 0.20	< 1.1	< 0.20	1.0 J	0.19 J	< 1.1	< 0.20	< 1.1	< 0.20	< 1.1	< 0.20	< 1.1	< 0.20	< 1.1	< 0.20
Trichloroethylene (TCE)		5	0.92	< 1.1	< 0.20	< 1.1	< 0.20	< 1.1	< 0.20	< 1.1	< 0.20	< 1.1	< 0.20	< 1.1	< 0.20	< 1.1	<0.20	< 1.1	< 0.20

General Notes:

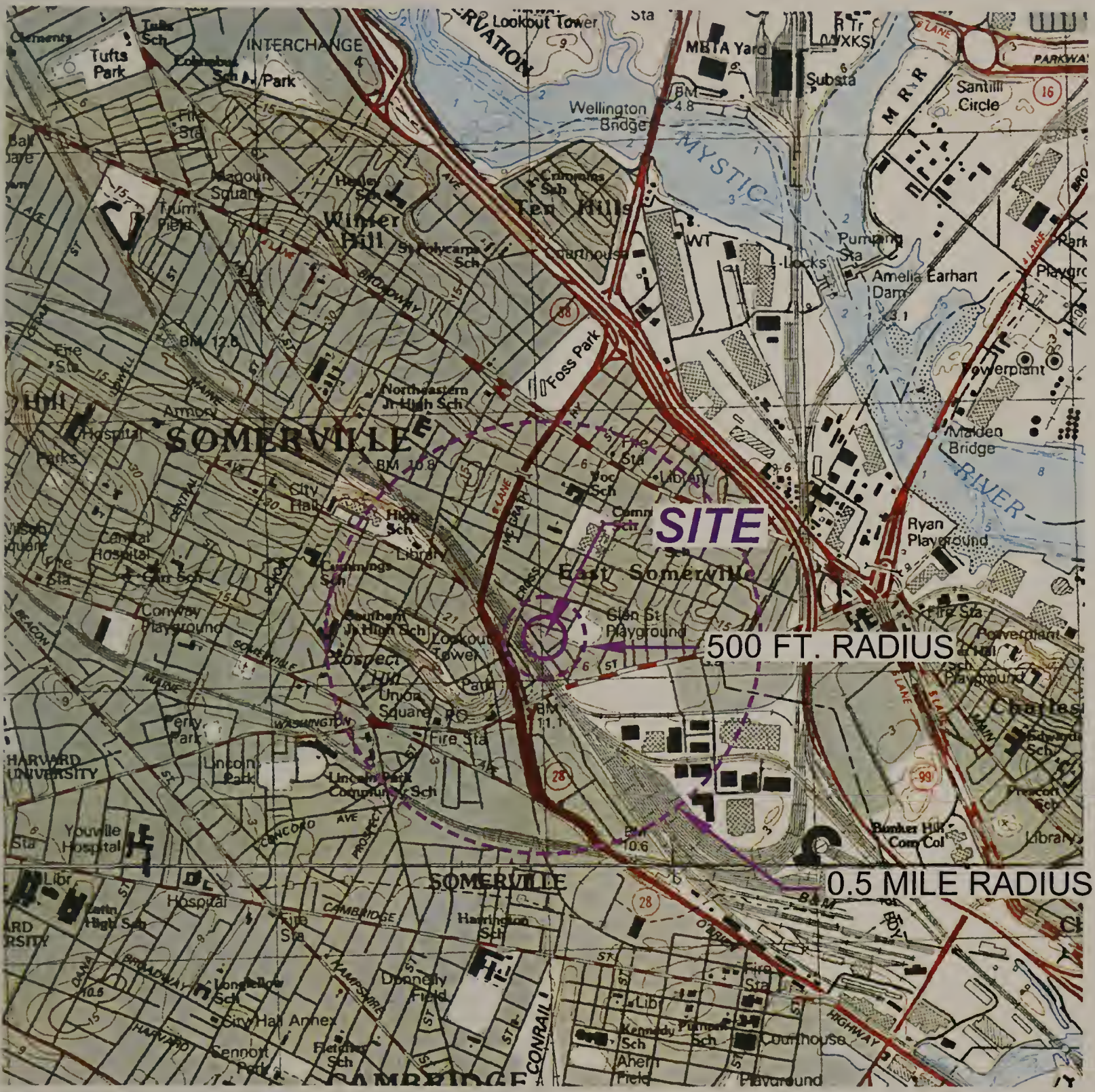
1. Analytes detected in at least one sample are reported here. For a complete list of analytes see the laboratory data sheets.
2. ug/m³ = micrograms per cubic meter.
3. ppbV = parts per billion by volume.
4. DEP Background Concentrations obtained from MADEP BWSC NERO Memorandum "Latest Revision of the Indoor Air Contaminants Comparison Table," dated August 2002.
5. NS = No DEP Background Concentration has been established for this compound.
6. "<" = The analyte was not detected at a concentration above the specified laboratory reporting limit.
7. Results in bold exceed the DEP Background Concentration in Indoor Air.

Qualifying Notes:

J The reported result is below the laboratory reporting limit and is estimated.
L The reported result is estimated because the calculated relative percent difference (RPD) between a sample and the matrix duplicate was above the quality control limit specified in the Quality Assurance Project Plan (QAPP).
M The reporting limit is elevated due to a detection of the analyte in a method blank sample, trip blank sample, or both.

GEI Consultants

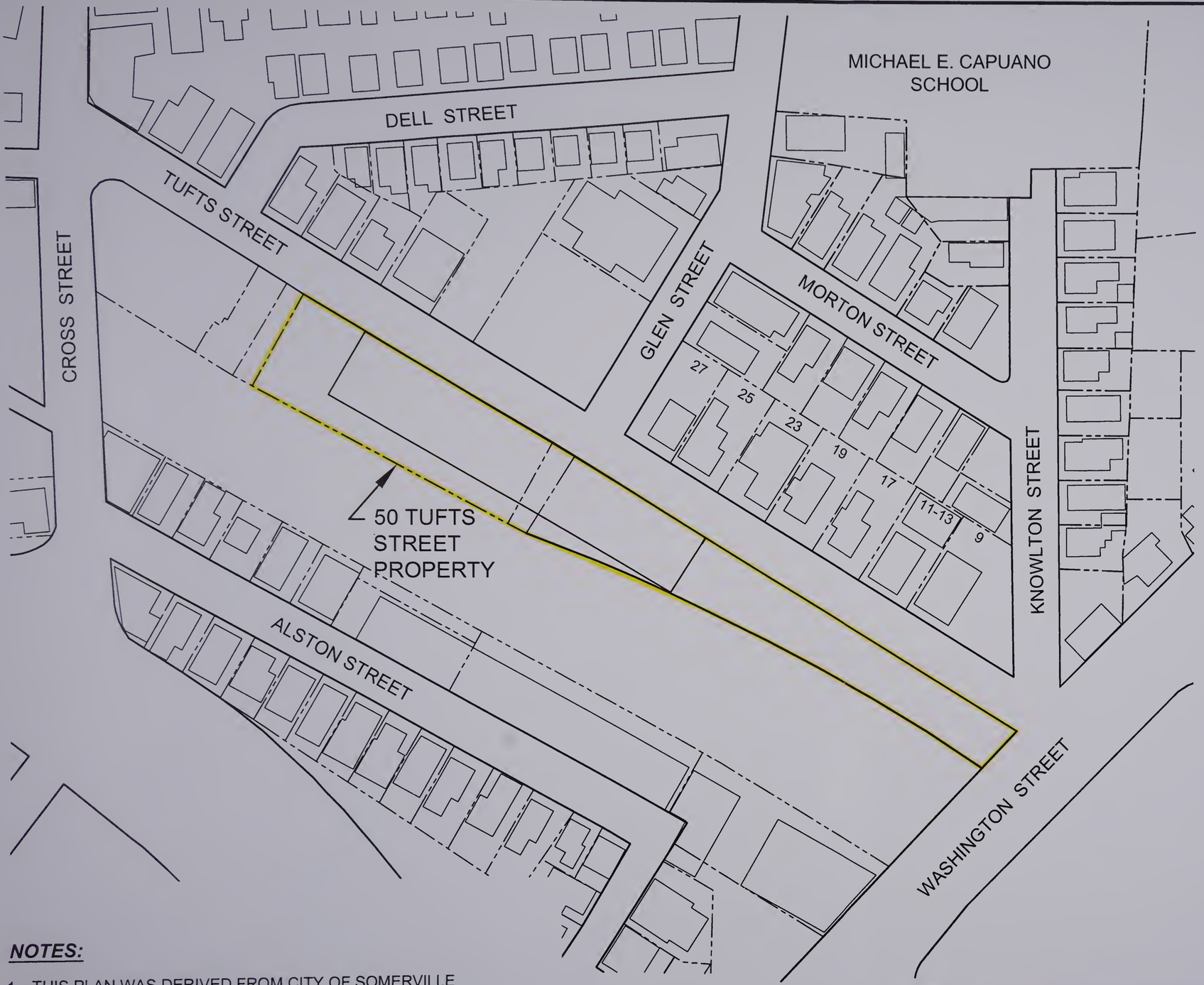
Geotechnical
Environmental and
Water Resources
Engineering



This Image provided by MassGIS is taken from
U.S.G.S. Topographic 7.5 X 15 Minute Series
Boston North, MA Quadrangle, 1985.
Datum is National Geodetic Vertical Datum (NGVD).
Contour Interval is 3 Meters.

50 Tufts Street Somerville, Massachusetts	GEI Consultants	SITE LOCATION MAP
UniFirst Corporation Wilmington, Massachusetts	Project 04516-2	September 2006 Fig. 1

N: 04516-28 ptc/djm 9/15/06



NOTES:

1. THIS PLAN WAS DERIVED FROM CITY OF SOMERVILLE ASSESSORS MAP NO. 93 AND 104, DATED JANUARY 3, 2001.

0 100 200

SCALE, FEET

50 Tufts Street Somerville, Massachusetts	GEI Consultants	SITE PLAN
UniFirst Corporation Wilmington, Massachusetts	Project 04516-2	September 2006 Fig. 2

N: 045160-29 djm/ptc 9/15/06

GEI Consultants

Geotechnical
Environmental and
Water Resources
Engineering

ATTACHMENT A

Release Notification and Release Notification Retraction Form
(BWSC-103)

Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup

BWSC103

RELEASE NOTIFICATION & NOTIFICATION RETRACTION FORM

Pursuant to 310 CMR 40.0335 and 310 CMR 40.0371 (Subpart C)

Release Tracking Number: 3 - 26114

A. RELEASE OR THREAT OF RELEASE LOCATION:

1. Release Name/Location Aid: NO LOCATION AID

2. Street Address: 50 TUFTS ST

3. City/Town: SOMERVILLE 4. ZIP Code:

5. UTM Coordinates: a. UTM N: 4694322 b. UTM E: 328049 Identify Location of Release

B. THIS FORM IS BEING USED TO: (check one)

☐ 1. Submit a **Release Notification**

☐ 2. Submit a **Revised Release Notification**

☑ 3. Submit a **Retraction of a Previously Reported Notification** of a release or threat of release including supporting documentation required pursuant to 310 CMR 40.0335 (Section C is not required)

(All sections of this transmittal form must be filled out unless otherwise noted above)

C. INFORMATION DESCRIBING THE RELEASE OR THREAT OF RELEASE (TOR):

1. Date and time of Oral Notification, if applicable: ____ (mm/dd/yyyy) Time: ____ (hh:mm) ☐ AM ☐ PM

2. Date and time you obtained knowledge of the Release or TOR: ____ (mm/dd/yyyy) Time: ____ (hh:mm) ☐ AM ☐ PM

3. Date and time release or TOR occurred, if known: ____ (mm/dd/yyyy) Time: ____ (hh:mm) ☐ AM ☐ PM

Check all Notification Thresholds that apply to the Release or Threat of Release:
(for more information see 310 CMR 40.0310 - 40.0315)

4. 2 HOUR REPORTING CONDITIONS

- ☐ a. Sudden Release
- ☐ b. Threat of Sudden Release
- ☐ c. Oil Sheen on Surface Water
- ☐ d. Poses Imminent Hazard
- ☐ e. Could Pose Imminent Hazard
- ☐ f. Release Detected in Private Well
- ☐ g. Release to Storm Drain
- ☐ h. Sanitary Sewer Release (Imminent Hazard Only)

5. 72 HOUR REPORTING CONDITIONS

- ☐ a. Subsurface Non-Aqueous Phase Liquid (NAPL) Equal to or Greater than 1/2 Inch
- ☐ b. Underground Storage Tank (UST) Release
- ☐ c. Threat of UST Release
- ☐ d. Release to Groundwater near Water Supply
- ☐ e. Release to Groundwater near School or Residence
- ☐ f. Substantial Release Migration

6. 120 DAY REPORTING CONDITIONS

- ☐ a. Release of Hazardous Material(s) to Soil or Groundwater Exceeding Reportable Concentration(s)
- ☐ b. Release of Oil to Soil Exceeding Reportable Concentration(s) and Affecting More than 2 Cubic Yards
- ☐ c. Release of Oil to Groundwater Exceeding Reportable Concentration(s)
- ☐ d. Subsurface Non-Aqueous Phase Liquid (NAPL) Equal to or Greater than 1/8 Inch and Less than 1/2 Inch

Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup

BWSC103

RELEASE NOTIFICATION & NOTIFICATION RETRACTION FORM

Release Tracking Number
3 - 26114

Pursuant to 310 CMR 40.0335 and 310 CMR 40.0371 (Subpart C)

C. INFORMATION DESCRIBING THE RELEASE OR THREAT OF RELEASE (TOR): (cont.)

7. List below the Oils (O) or Hazardous Materials (HM) that exceed their Reportable Concentration (RC) or Reportable Quantity (RQ) by the greatest amount.

O or HM Released	CAS Number, if known	O or HM	Amount or Concentration	Units	RCs Exceeded, if Applicable (RCS-1, RCS-2, RCGW-1, RCGW-2)

☐ 8. Check here if a list of additional Oil and Hazardous Materials subject to reporting is attached.

D. PERSON REQUIRED TO NOTIFY:

1. Check all that apply: ☐ a. change in contact name ☐ b. change of address ☐ c. change in the person notifying

2. Name of Organization: UNIFIRST CORP

3. Contact First Name: BRIAN 4. Last Name: KEEGAN

5. Street: 68 JONSPIN RD 6. Title: ENV ENG MANAGER

7. City/Town: WILMINGTON 8. State: MA 9. ZIP Code: 01887-0000

10. Telephone: (800) 347-7888 11. Ext.: 12. FAX:

☐ 13. Check here if attaching names and addresses of owners of properties affected by the Release or Threat of Release, other than an owner who is submitting this Release Notification (required).

E. RELATIONSHIP OF PERSON TO RELEASE OR THREAT OF RELEASE:

☑ 1. RP or PRP ☐ a. Owner ☐ b. Operator ☐ c. Generator ☐ d. Transporter

☑ e. Other RP or PRP Specify: PRP GENERIC OR NON-SPECIFIED

☐ 2. Fiduciary, Secured Lender or Municipality with Exempt Status (as defined by M.G.L. c. 21E, s. 2)

☐ 3. Agency or Public Utility on a Right of Way (as defined by M.G.L. c. 21E, s. 5(j))

☐ 4. Any Other Person Otherwise Required to Notify Specify Relationship:

Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup

BWSC103

RELEASE NOTIFICATION & NOTIFICATION RETRACTION FORM

Release Tracking Number
3 - 26114

Pursuant to 310 CMR 40.0335 and 310 CMR 40.0371 (Subpart C)

F. CERTIFICATION OF PERSON REQUIRED TO NOTIFY:

1. I BRIAN KEEGAN, attest under the pains and penalties of perjury (i) that I have personally examined and am familiar with the information contained in this submittal, including any and all documents accompanying this transmittal form, (ii) that, based on my inquiry of those individuals immediately responsible for obtaining the information, the material information contained in this submittal is, to the best of my knowledge and belief, true, accurate and complete, and (iii) that I am fully authorized to make this attestation on behalf of the entity legally responsible for this submittal. I/the person or entity on whose behalf this submittal is made am/is aware that there are significant penalties, including, but not limited to, possible fines and imprisonment, for willfully submitting false, inaccurate, or incomplete information.

2. By: Brian E Keegan (Signature) 3. Title: ENV ENG MANAGER

4. For: UNIFIRST CORP (Name of person or entity recorded in Section D) 5. Date: 09/15/06 mm/dd/yyyy

☐ 6. Check here if the address of the person providing certification is different from address recorded in Section D.

7. Street: _____

8. City/Town: _____ 9. State: _____ 10. ZIP Code: _____

11. Telephone: _____ 12. Ext.: _____ 13. FAX: _____

YOU ARE SUBJECT TO AN ANNUAL COMPLIANCE ASSURANCE FEE OF UP TO $10,000 PER BILLABLE YEAR FOR THIS DISPOSAL SITE. YOU MUST LEGIBLY COMPLETE ALL RELEVANT SECTIONS OF THIS FORM OR DEP MAY RETURN THE DOCUMENT AS INCOMPLETE. IF YOU SUBMIT AN INCOMPLETE FORM, YOU MAY BE PENALIZED FOR MISSING A REQUIRED DEADLINE.

Date Stamp (DEP USE ONLY:)

GEI Consultants

Geotechnical
Environmental and
Water Resources
Engineering

ATTACHMENT B

AMEC Report

Assessment of Short Term Risk
50 Tufts Street Site
Somerville, Massachusetts

Executive Summary

The following report summarizes the results of the initial Imminent Hazard Evaluation that AMEC Earth & Environmental (AMEC) of Westford, Massachusetts conducted when indoor air analyses became available from June 2006 sampling at homes along Tufts Street in Somerville, Massachusetts (the Report). On the basis of this single data set, UniFirst Corporation (UniFirst), as a Potentially Responsible Party, notified DEP that an Imminent Hazard condition may exist and undertook planning to re-sample the two residences as soon as practicable to determine if the June 2006 sample results were anomalous in some way or actually characterized the expected indoor air concentrations of Constituents of Potential Concern (COPCs) in the two residences over a five year period.

The Report summarizes the updated Imminent Hazard Evaluation that was performed when additional data became available from the re-sampling that was done in homes in August 2006. Based on the re-sampling results, AMEC concludes that the June 2006 results were anomalous and do not, in fact, characterize the indoor air concentrations of COPCs in two Tufts Street residences over a five year period. Consequently, no Imminent Hazard condition exists or did exist. The initial notification was submitted to DEP as a regulatory requirement to ensure that a potential Imminent Hazard condition, if present, was timely reported. The Report indicates that an Imminent Hazard does not exist.

I. Introduction

On behalf of UniFirst, GEI Consultants, Inc. (GEI) conducted indoor air sampling in June 2006 at several residences that were previously sampled by GEI in March 2006 and by the Massachusetts Department of Environmental Protection (DEP) in February 2005. The DEP had requested additional rounds of air testing be conducted in these homes periodically over the course of the next year to create a more complete sampling record. Specifically, indoor air sampling was performed on June 28 and 29, 2006 at 11 Tufts Street, 19 Tufts Street, 23 Tufts Street, and 27 Tufts Street.

The concentrations of tetrachloroethylene (PCE) measured in the basements and first floor apartments of several residences in June 2006 were higher than those measured by the DEP in 2005 and by GEI in March 2006. Accordingly, UniFirst requested AMEC to evaluate if the conditions of an Imminent Hazard, in accordance with definitions in the Massachusetts Contingency Plan, were met in any of these four houses.

II. Definition of Imminent Hazard

AMEC consulted the definition of an Imminent Hazard, which is a "hazard which would pose a significant risk of harm to health, safety, public welfare or the environment if it were present for even a short period of time…" In addition, AMEC consulted the description at 310 CMR 40.0950. According to this description, a short period of time is intended by DEP to be "five years unless site circumstances indicate that a shorter time period is appropriate." Further, the specific period of time is dependent on the "nature of hazard under investigation and the projected time until a Comprehensive Response Action could be completed…"

UniFirst is actively characterizing the 50 Tufts Street Site. Because the investigation currently is in Phase II, it is not yet known what Comprehensive Response Action will be selected or what the projected time is for completion. AMEC took the most health protective approach and defined "a short period of time" as five years for the risk characterization.

310 CMR 40.0950 states that the characterization of risk of harm to human health should be conducted in accordance with Method 3 requirements. The conditions of an Imminent Hazard exist if the estimated Excess Lifetime Cancer Risk exceeds 1/100,000 (i.e., 1×10^{-5}) for each receptor or if the Hazard Index exceeds 1 for constituents that have the potential to cause serious effects following short-term exposures, such as cyanide. For all other constituents, an Imminent Hazard exists if the Hazard Index exceeds 10.

None of the COPCs have the potential to cause serious adverse effects following short-term exposures, so the criterion for an Imminent Hazard at this site is a Hazard Index of 10.

III. Definition of Constituents of Potential Concern

The oil or hazardous materials that have been detected at least once in indoor air in basements and first floor apartments on Tufts Street that potentially may be site-related include the following chlorinated hydrocarbons:

- Tetrachloroethylene (PCE);
- Trichloroethylene (TCE);
- Carbon tetrachloride;
- 1,2-dichloroethane; and
- 1,1,1-trichloroethane.

These constituents have been designated as COPCs for all homes regardless of whether they have been detected in indoor air in an individual home, and without regard to the fact that they may be present as a result of off-gassing from common household products or other "background" sources. That is, if a COPC has been detected at least once in at least one home, it was included in the risk characterization for all homes on Tufts Street. To be clear, designation of a constituent for further evaluation here does not mean or imply that any particular constituent detection, in nature or concentration, is site-related.

IV. Data Management Issues

In cases where duplicate measurements were taken at the same location during a sampling event, the results of the duplicate analyses were averaged to define the exposure point concentration for that location and sampling date.

In cases where COPCs were not detected at a specific sample location during a specific sampling event, the "non-detect" value was evaluated using one-half the sample quantitation limit as a surrogate value.

Both of these practices are standard risk characterization practices that are consistent with Method 3 Risk Characterizations performed in accordance with MCP requirements.

Indoor air samples were collected separately in basements and first floor apartments of the homes. In addition, samples were taken separately in two first floor apartments at 9 Tufts Street, the right apartment and the left apartment. None of these data were averaged. All data from different locations were evaluated separately so as to properly and conservatively characterize the risk to individual receptors.

V. Toxicity Assessment

AMEC evaluated the regulatory toxicology literature and identified the most up-to-date Reference Concentrations (RfCs) and Unit Risk Values (Ur_is) to characterize the risk to human health from COPCs that are associated with noncarcinogenic effects and those that are associated with carcinogenic effects, respectively. The toxicity values are shown in Table 1.

TABLE 1
TOXICITY VALUES

COPC	Reference Concentration (RfC) (mg/m^3)	Unit Risk Value (Ur_i) $(ug/m^3)^{-1}$	Sources (RfC, Ur_i)
Tetrachlorothylene	3.5E-02	5.71E-06	Region IX, Region III
Trichloroethylene	3.5E-02	1.7E-06	Region III, MADEP
Carbon tetrachloride	4.3E-01	1.50E-05	MADEP, EPA IRIS
1,2-dichlorethane	5.5E-02	2.60E-05	MADEP, EPA IRIS
1,1,1-trichloroethane	5.2E+00	Not applicable	MADEP

VI. Exposure Assessment

Three of the four homes have unfinished basements. It is not known if residents in the first floor apartments have access to the basements in these homes. However, it is possible that receptors from the first floor apartments may enter the basements from time to time. For present purposes, AMEC conservatively assumes that a receptor may

spend as much as four hours a day or 28 hours a week in the basements at these three homes. This assumption is very likely to overestimate the amount of time that receptors spend in the basements.

At 23 Tufts Street, there is a finished basement. However, for present purposes, until better information is available, AMEC has assumed that a receptor may spend 12 hours a day in this basement as a worst case assumption.

Thus, AMEC assumes for the Imminent Hazard Evaluation that receptors spend 20 hours in the first floor apartment and four hours in the basement every day for five years for 11 Tufts Street, 19 Tufts Street, and 27 Tufts Street. For 23 Tufts Street, it is assumed that receptors spend 12 hours in the first floor apartment and 12 hours in the basement every day for five years.

VII. Initial Imminent Hazard Evaluation (Risk Characterization)

At the time that the June 2006 sampling results became available from the laboratory, the available indoor air data from the four homes consisted of data from February 2005, March 2006 and June 2006. In several cases, the June 2006 results were considerably higher than the results of the previous two sampling rounds. AMEC took a very conservative approach when performing the Imminent Hazard evaluation. AMEC asked the question: "What would the noncarcinogenic and carcinogenic risks be for the receptors if the indoor air concentrations from June 2006 persisted continuously, every day, for five years?"

In fact, the MCP does not specify that such a conservative approach be taken when performing an Imminent Hazard Evaluation. It is more reasonable to assume that the exposure point concentration for the five year period of concern is an average concentration that considers all previous results. At the time of the initial Imminent Hazard Evaluation, it was possible, although not likely, that environmental conditions had changed at the site such that indoor air concentrations from June 2006 into the future might be more like the results from the June 2006 sampling than from the March 2006 sampling. Pending the results of confirmatory sampling, and in the context of assessing the potential applicability of the reporting requirements under 310 CMR 40.0311(7), AMEC took the conservative approach of assuming that receptors might be exposed to the June 2006 concentrations for a full five-year period.

Risk assessment results from the initial Imminent Hazard Evaluation performed with the June 2006 sampling data are shown below in Table 2. The calculation spreadsheets are presented in Appendix A. As can be seen, the estimated Excess Lifetime Cancer Risk to receptors assumed to live at 23 Tufts Street and 27 Tufts Street for five years without any remedial actions assumed was greater than 1/100,000 for 23 Tufts Street and equal to 1/100,000 for 27 Tufts Street. In no case was the Hazard Index above 10.

TABLE 2
INITIAL IMMINENT HAZARD EVALUATION RESULTS
FROM JUNE 2006 SAMPLING

Residence	Hazard Index[1]	Excess Lifetime Cancer Risk[2]
11 Tufts Street	0.1	3E-06
19 Tufts Street	0.1	3E-06
23 Tufts Street	3.2	5E-05[3]
27 Tufts Street	0.7	1E-05

[1] Imminent Hazard Criterion = Hazard Index >10
[2] Imminent Hazard Criterion = Excess Lifetime Cancer Risk > 1E-05
[3] Exceeds Imminent Hazard Criterion

This conservative approach to an Imminent Hazard Evaluation was used based on the best information available at the time the June 2006 sampling data arrived from the analytical laboratory and was validated. Based on the fact that the conservative Imminent Hazard Evaluation showed that one home exceeded the Imminent Hazard criterion for Excess Lifetime Cancer Risk and one home was equal to the criterion, UniFirst notified DEP of a potential Imminent Hazard and arranged to resample the two homes as soon as practicable. Samples were taken in the basements and first floor apartments of 23 Tufts Street and 27 Tufts Street on August 3, 2006.

As will be described in detail in Section VIII, more recent sampling data dictates that there was, in fact, no Imminent Hazard at any location.

VIII. Updated Imminent Hazard Evaluation (Risk Characterization)

Concentrations of COPCs in indoor air were considerably lower at 23 Tufts Street and 27 Tufts Street on August 3, 2006 compared to June 2006, demonstrating that the concentrations assumed for the initial Imminent Hazard Evaluation were, indeed, overly conservative. The initial assumption that receptors would be exposed to the June 2006 concentrations daily for five full years was not, in fact, borne out by the facts.

AMEC considered performing the updated Imminent Hazard Evaluation for 23 and 27 Tufts Street assuming that receptors would be exposed to the August 2006 concentrations daily for five full years. However, this approach was rejected because it would not take into account the June 2006 results.

The Imminent Hazard Evaluation was updated assuming that receptors were exposed to average COPC concentrations for a full five year period. The average concentrations take into account all four sampling rounds: February 2005, March 2006, June 2006, and August 2006. Thus, all available data are taken into account. This approach is conservative, because it assumes that the June 2006 data contributed to potential receptor exposures equally compared to the other three data sets, even though, when compared to other sampling results from the same locations, the June 2006 data in fact are anomalous.

The results of this updated evaluation (see Table 3) demonstrate that an Imminent Hazard condition does not and never did exist at these two residences. The calculation spreadsheets are presented in Appendix B.

TABLE 3
UPDATED IMMINENT HAZARD EVALUATION RESULTS
AVERAGE OF ALL FOUR ROUNDS OF DATA

Residence	Hazard Index[1]	Excess Lifetime Cancer Risk[2]
23 Tufts Street	0.9	1E-05
27 Tufts Street	0.2	4E-06

[1] Imminent Hazard Criterion = Hazard Index >10
[2] Imminent Hazard Criterion = Excess Lifetime Cancer Risk > 1E-05

IX. Imminent Hazard Evaluation (Risk Characterization) for Recently Sampled Residences That Were Not Sampled in June 2006

Access to the 9 Tufts Street and 25 Tufts Street residences was not obtained during the late June 2006 sampling period. The two residences were sampled on July 24, 2006 and August 1, 2006, respectively. To ensure that a condition of Imminent Hazard does not exist at either of these two residences, the Imminent Hazard Evaluation was performed for the most recent sampling data from these two residences. As shown below in Table 4, a condition of Imminent Hazard does not exist at these two residences. The calculation spreadsheets are presented in Appendix C.

TABLE 4
IMMINENT HAZARD EVALUATION RESULTS
JULY 24 AND AUGUST 1, 2006 DATA

Residence	Hazard Index[1]	Excess Lifetime Cancer Risk[2]
9 Tufts Street, Left Apartment	0.1	2E-06
9 Tufts Street, Right Apartment	0.1	2E-06
25 Tufts Street	0.1	2E-06

[1] Imminent Hazard Criterion = Hazard Index >10
[2] Imminent Hazard Criterion = Excess Lifetime Cancer Risk > 1E-05

X. Conclusions

Pending the results of confirmatory sampling, and in the context of assessing the potential applicability of the reporting requirements under 310 CMR 40.0311(7), AMEC performed a very conservative Imminent Hazard Evaluation when residential indoor air sample results were higher in June 2006 than previously observed. AMEC took the conservative approach of assuming that receptors might be exposed to the June 2006 concentrations for a full five-year period. Based on that approach, estimated risks "for a short period of time" exceeded the Excess Lifetime Cancer Risk criterion at one residence for the definition of an Imminent Hazard in accordance with 310 CMR 40.0955 when "a short period of time" was defined conservatively as five full years.

UniFirst notified DEP that an Imminent Hazard condition may exist and undertook planning to re-sample the two residences as soon as practicable to determine if the June 2006 sample results were anomalous or actually characterized the expected long-term indoor air concentrations of COPCs in the two residences. Based on the re-sampling results, AMEC concludes that the June 2006 results at these two residences (23 and 27 Tufts Street) were anomalous and do not, in fact, characterize the indoor air concentrations of COPCs in the two residences over a five year period. Consequently, no Imminent Hazard condition exists or did exist.

Appendix A
Exposure and Risk Estimates Associated With Inhalation of Volatile Compounds in Air
UniFirst
Tufts St.
Resident Adult
Indoor Air
11 Tufts St., Basement
06/29/2006

Receptor:	
Exposure Medium:	
Exposure Area:	
Duration:	

Parameter	Definition	Units	Value	Source	Comment
ET	Indoor Air Exposure Time	h/d	4	d	
EF	Indoor Air Exposure Frequency	d/y	365	d	
EP	Indoor Air Exposure Period	y	5	d	
ATc	Indoor Air Averaging Time - Cancer	d	25550	c	
ATn	Indoor Air Averaging Time - Non-Cancer	d	1825	c	
C	Conversion Factor	ug/mg	1000		

$$ADE_{inh} = \frac{C_{air} \times RAF_i \times ET \times EF \times EP}{24hr/d \times AT}$$

$$Risk = ADE_{inh} \times URF \times C$$

$$HI_{inh} = \frac{ADE_{inh}}{RfC}$$

Compound	EPC Indoor Air (mg/m3)		RfC (mg/m3)	URF 1/(ug/m3)	RAFic	ADE-c mg/m3	Riskinh	RAFinc	ADE-nc mg/m3	Hlinh	Risk (Indoor Air)	HI (Indoor Air)
Carbon tetrachloride	6.90E-04		4.30E-01	1.50E-05	1	8.21E-06	1.23E-07	1	1.15E-04	2.67E-04	1.23E-07	2.67E-04
1,2-Dichloroethane	4.05E-04	ND	5.50E-02	2.60E-05	1	4.82E-06	1.25E-07	1	6.75E-05	1.23E-03	1.25E-07	1.23E-03
Tetrachloroethylene	2.40E-03		3.50E-02	5.71E-06	1	2.86E-05	1.63E-07	1	4.00E-04	1.14E-02	1.63E-07	1.14E-02
1,1,1-Trichloroethane	5.50E-04	ND	5.20E+00	NA	1	NA	NA	1	9.17E-05	1.76E-05	NA	1.76E-05
Trichloroethylene	5.50E-04	ND	3.50E-02	1.70E-06	1	6.55E-06	1.11E-08	1	9.17E-05	2.62E-03	1.11E-08	2.62E-03
Total							4.23E-07			1.56E-02	4.23E-07	1.56E-02

NA - Not available
NC - Not calculated
ND - Not detected

Appendix A
Exposure and Risk Estimates Associated With Inhalation of Volatile Compounds in Air
UniFirst
Tufts St.
Resident Adult
Indoor Air
11 Tufts St., 1st Floor
06/29/2006

Receptor:	
Exposure Medium:	
Exposure Area:	
Duration:	

$$ADE_{inh} = \frac{C_{air} \times RAF_i \times ET \times EF \times EP}{24hr/d \times AT}$$

$$Risk = ADE_{inh} \times URF \times C$$

$$HI_{inh} = \frac{ADE_{inh}}{RfC}$$

Parameter	Definition	Units	Value	Source	Comment
ET	Indoor Air Exposure Time	h/d	20	d	
EF	Indoor Air Exposure Frequency	d/y	365	d	
EP	Indoor Air Exposure Period	y	5	d	
ATc	Indoor Air Averaging Time - Cancer	d	25550	c	
ATn	Indoor Air Averaging Time - Non-Cancer	d	1825	c	
C	Conversion Factor	ug/mg	1000		

Compound	EPC Indoor Air (mg/m3)		RfC (mg/m3)	URF 1/(ug/m3)	RAFic	ADE-c mg/m3	Riskinh	RAFinc	ADE-nc mg/m3	HIinh	Risk (Indoor Air)	HI (Indoor Air)
Carbon tetrachloride	6.90E-04		4.30E-01	1.50E-05	1	4.11E-05	6.16E-07	1	5.75E-04	1.34E-03	6.16E-07	1.34E-03
1,2-Dichloroethane	8.50E-04		5.50E-02	2.60E-05	1	5.06E-05	1.32E-06	1	7.08E-04	1.29E-02	1.32E-06	1.29E-02
Tetrachloroethylene	1.80E-03		3.50E-02	5.71E-06	1	1.07E-04	6.12E-07	1	1.50E-03	4.29E-02	6.12E-07	4.29E-02
1,1,1-Trichloroethane	7.10E-04		5.20E+00	NA	1	NA	NA	1	5.92E-04	1.14E-04	NA	1.14E-04
Trichloroethylene	5.50E-04	ND	3.50E-02	1.70E-06	1	3.27E-05	5.57E-08	1	4.58E-04	1.31E-02	5.57E-08	1.31E-02
Total							2.60E-06			7.03E-02	2.60E-06	7.03E-02

NA - Not available
NC - Not calculated
ND - Not detected

Appendix A
Exposure and Risk Estimates Associated With Inhalation of Volatile Compounds in Air
UniFirst
Tufts St.
Resident Adult
Indoor Air
19 Tufts St., Basement
06/29/2006

Receptor:	
Exposure Medium:	
Exposure Area:	
Duration:	

Parameter	Definition	Units	Value	Source	Comment
ET	Indoor Air Exposure Time	h/d	4	d	
EF	Indoor Air Exposure Frequency	d/y	365	d	
EP	Indoor Air Exposure Period	y	5	d	
ATc	Indoor Air Averaging Time - Cancer	d	25550	c	
ATn	Indoor Air Averaging Time - Non-Cancer	d	1825	c	
C	Conversion Factor	ug/mg	1000		

$$ADE_{inh} = \frac{C_{air} \times RAF_i \times ET \times EF \times EP}{24hr/d \times AT}$$

$$Risk = ADE_{inh} \times URF \times C$$

$$HI_{inh} = \frac{ADE_{inh}}{RfC}$$

Compound	EPC Indoor Air (mg/m3)		RfC (mg/m3)	URF 1/(ug/m3)	RAFic	ADE-c mg/m3	Riskinh	RAFinc	ADE-nc mg/m3	Hlinh	Risk (Indoor Air)	HI (Indoor Air)
Carbon tetrachloride	6.90E-04		4.30E-01	1.50E-05	1	8.21E-06	1.23E-07	1	1.15E-04	2.67E-04	1.23E-07	2.67E-04
1,2-Dichloroethane	4.05E-04	ND	5.50E-02	2.60E-05	1	4.82E-06	1.25E-07	1	6.75E-05	1.23E-03	1.25E-07	1.23E-03
Tetrachloroethylene	3.95E-03		3.50E-02	5.71E-06	1	4.70E-05	2.69E-07	1	6.58E-04	1.88E-02	2.69E-07	1.88E-02
1,1,1-Trichloroethane	5.50E-04	ND	5.20E+00	NA	1	NA	NA	1	9.17E-05	1.76E-05	NA	1.76E-05
Trichloroethylene	1.85E-03		3.50E-02	1.70E-06	1	2.20E-05	3.74E-08	1	3.08E-04	8.81E-03	3.74E-08	8.81E-03
Total							5.55E-07			2.91E-02	5.55E-07	2.91E-02

NA - Not available
NC - Not calculated
ND - Not detected

Appendix A
Exposure and Risk Estimates Associated With Inhalation of Volatile Compounds in Air
UniFirst
Tufts St.
Resident Adult
Indoor Air
19 Tufts St., 1st Floor
06/29/2006

Receptor:	
Exposure Medium:	
Exposure Area:	
Duration:	

$$ADE_{inh} = \frac{C_{air} \times RAF_i \times ET \times EF \times EP}{24hr/d \times AT}$$

$$Risk = ADE_{inh} \times URF \times C$$

$$HI_{inh} = \frac{ADE_{inh}}{RfC}$$

Parameter	Definition	Units	Value	Source	Comment
ET	Indoor Air Exposure Time	h/d	20	d	
EF	Indoor Air Exposure Frequency	d/y	365	d	
EP	Indoor Air Exposure Period	y	5	d	
ATc	Indoor Air Averaging Time - Cancer	d	25550	c	
ATn	Indoor Air Averaging Time - Non-Cancer	d	1825	c	
C	Conversion Factor	ug/mg	1000		

Compound	EPC Indoor Air (mg/m3)		RfC (mg/m3)	URF 1/(ug/m3)	RAFic	ADE-c mg/m3	Riskinh	RAFinc	ADE-nc mg/m3	Hlinh	Risk (Indoor Air)	HI (Indoor Air)
Carbon tetrachloride	6.90E-04		4.30E-01	1.50E-05	1	4.11E-05	6.16E-07	1	5.75E-04	1.34E-03	6.16E-07	1.34E-03
1,2-Dichloroethane	4.05E-04	ND	5.50E-02	2.60E-05	1	2.41E-05	6.27E-07	1	3.38E-04	6.14E-03	6.27E-07	6.14E-03
Tetrachloroethylene	2.40E-03		3.50E-02	5.71E-06	1	1.43E-04	8.16E-07	1	2.00E-03	5.71E-02	8.16E-07	5.71E-02
1,1,1-Trichloroethane	5.50E-04	ND	5.20E+00	NA	1	NA	NA	1	4.58E-04	8.81E-05	NA	8.81E-05
Trichloroethylene	1.70E-03		3.50E-02	1.70E-06	1	1.01E-04	1.72E-07	1	1.42E-03	4.05E-02	1.72E-07	4.05E-02
Total							2.23E-06			1.05E-01	2.23E-06	1.05E-01

NA - Not available
NC - Not calculated
ND - Not detected

Appendix A
Exposure and Risk Estimates Associated With Inhalation of Volatile Compounds in Air
UniFirst
Tufts St.
Resident Adult
Indoor Air
23 Tufts St., Basement
06/28/2006

Receptor:	
Exposure Medium:	
Exposure Area:	
Duration:	

Parameter	Definition	Units	Value	Source	Comment
ET	Indoor Air Exposure Time	h/d	4	d	
EF	Indoor Air Exposure Frequency	d/y	365	d	
EP	Indoor Air Exposure Period	y	5	d	
ATc	Indoor Air Averaging Time - Cancer	d	25550	c	
ATn	Indoor Air Averaging Time - Non-Cancer	d	1825	c	
C	Conversion Factor	ug/mg	1000		

$$ADE_{inh} = \frac{C_{air} \times RAF_i \times ET \times EF \times EP}{24hr/d \times AT}$$

$$Risk = ADE_{inh} \times URF \times C$$

$$HI_{inh} = \frac{ADE_{inh}}{RfC}$$

Compound	EPC Indoor Air (mg/m3)		RfC (mg/m3)	URF 1/(ug/m3)	RAFic	ADE-c mg/m3	Riskinh	RAFinc	ADE-nc mg/m3	Hlinh	Risk (Indoor Air)	HI (Indoor Air)
Carbon tetrachloride	6.50E-04	ND	4.30E-01	1.50E-05	1	7.74E-06	1.16E-07	1	1.08E-04	2.52E-04	1.16E-07	2.52E-04
1,2-Dichloroethane	4.05E-04	ND	5.50E-02	2.60E-05	1	4.82E-06	1.25E-07	1	6.75E-05	1.23E-03	1.25E-07	1.23E-03
Tetrachloroethylene	1.25E-01		3.50E-02	5.71E-06	1	1.49E-03	8.50E-06	1	2.08E-02	5.95E-01	8.50E-06	5.95E-01
1,1,1-Trichloroethane	1.50E-03		5.20E+00	NA	1	NA	NA	1	2.50E-04	4.81E-05	NA	4.81E-05
Trichloroethylene	1.00E-03		3.50E-02	1.70E-06	1	1.19E-05	2.02E-08	1	1.67E-04	4.76E-03	2.02E-08	4.76E-03
Total							8.77E-06			6.02E-01	8.77E-06	6.02E-01

NA - Not available
NC - Not calculated
ND - Not detected

Appendix A
Exposure and Risk Estimates Associated With Inhalation of Volatile Compounds in Air
UniFirst
Tufts St.
Resident Adult
Indoor Air
23 Tufts St., 1st Floor
06/28/2006

Receptor:	
Exposure Medium:	
Exposure Area:	
Duration:	

$$ADE_{inh} = \frac{C_{air} \times RAF_i \times ET \times EF \times EP}{24hr/d \times AT}$$

$$Risk = ADE_{inh} \times URF \times C$$

$$HI_{inh} = \frac{ADE_{inh}}{RfC}$$

Parameter	Definition	Units	Value	Source	Comment
ET	Indoor Air Exposure Time	h/d	20	d	
EF	Indoor Air Exposure Frequency	d/y	365	d	
EP	Indoor Air Exposure Period	y	5	d	
ATc	Indoor Air Averaging Time - Cancer	d	25550	c	
ATn	Indoor Air Averaging Time - Non-Cancer	d	1825	c	
C	Conversion Factor	ug/mg	1000		

Compound	EPC Indoor Air (mg/m3)		RfC (mg/m3)	URF 1/(ug/m3)	RAFic	ADE-c mg/m3	Riskinh	RAFinc	ADE-nc mg/m3	Hlinh	Risk (Indoor Air)	HI (Indoor Air)
Carbon tetrachloride	9.40E-04		4.30E-01	1.50E-05	1	5.60E-05	8.39E-07	1	7.83E-04	1.82E-03	8.39E-07	1.82E-03
1,2-Dichloroethane	4.05E-04	ND	5.50E-02	2.60E-05	1	2.41E-05	6.27E-07	1	3.38E-04	6.14E-03	6.27E-07	6.14E-03
Tetrachloroethylene	9.49E-02		3.50E-02	5.71E-06	1	5.65E-03	3.23E-05	1	7.91E-02	2.26E+00	3.23E-05	2.26E+00
1,1,1-Trichloroethane	1.00E-03		5.20E+00	NA	1	NA	NA	1	8.33E-04	1.60E-04	NA	1.60E-04
Trichloroethylene	6.40E-04		3.50E-02	1.70E-06	1	3.81E-05	6.48E-08	1	5.33E-04	1.52E-02	6.48E-08	1.52E-02
Total							3.38E-05			2.28E+00	3.38E-05	2.28E+00

NA - Not available
NC - Not calculated
ND - Not detected

Appendix A
Exposure and Risk Estimates Associated With Inhalation of Volatile Compounds in Air
UniFirst
Tufts St.
Resident Adult
Indoor Air
27 Tufts St., Basement
06/28/2006

Receptor:	
Exposure Medium:	
Exposure Area:	
Duration:	

Parameter	Definition	Units	Value	Source	Comment
ET	Indoor Air Exposure Time	h/d	4	d	
EF	Indoor Air Exposure Frequency	d/y	365	d	
EP	Indoor Air Exposure Period	y	5	d	
ATc	Indoor Air Averaging Time - Cancer	d	25550	c	
ATn	Indoor Air Averaging Time - Non-Cancer	d	1825	c	
C	Conversion Factor	ug/mg	1000		

$$ADE_{inh} = \frac{C_{air} \times RAF_i \times ET \times EF \times EP}{24hr/d \times AT}$$

$$Risk = ADE_{inh} \times URF \times C$$

$$HI_{inh} = \frac{ADE_{inh}}{RfC}$$

Compound	EPC Indoor Air (mg/m3)		RfC (mg/m3)	URF 1/(ug/m3)	RAFic	ADE-c mg/m3	Riskinh	RAFinc	ADE-nc mg/m3	Hlinh	Risk (Indoor Air)	HI (Indoor Air)
Carbon tetrachloride	6.90E-04		4.30E-01	1.50E-05	1	8.21E-06	1.23E-07	1	1.15E-04	2.67E-04	1.23E-07	2.67E-04
1,2-Dichloroethane	4.05E-04	ND	5.50E-02	2.60E-05	1	4.82E-06	1.25E-07	1	6.75E-05	1.23E-03	1.25E-07	1.23E-03
Tetrachloroethylene	1.17E-01		3.50E-02	5.71E-06	1	1.39E-03	7.96E-06	1	1.95E-02	5.57E-01	7.96E-06	5.57E-01
1,1,1-Trichloroethane	1.00E-03		5.20E+00	NA	1	NA	NA	1	1.67E-04	3.21E-05	NA	3.21E-05
Trichloroethylene	5.50E-04	ND	3.50E-02	1.70E-06	1	6.55E-06	1.11E-08	1	9.17E-05	2.62E-03	1.11E-08	2.62E-03
Total							8.22E-06			5.61E-01	8.22E-06	5.61E-01

NA - Not available
NC - Not calculated
ND - Not detected

Appendix A
Exposure and Risk Estimates Associated With Inhalation of Volatile Compounds in Air
UniFirst
Tufts St.
Resident Adult
Indoor Air
27 Tufts St., 1st Floor
06/28/2006

Receptor:	
Exposure Medium:	
Exposure Area:	
Duration:	

$$ADE_{inh} = \frac{C_{air} \times RAF_i \times ET \times EF \times EP}{24hr/d \times AT}$$

$$Risk = ADE_{inh} \times URF \times C$$

$$HI_{inh} = \frac{ADE_{inh}}{RfC}$$

Parameter	Definition	Units	Value	Source	Comment
ET	Indoor Air Exposure Time	h/d	20	d	
EF	Indoor Air Exposure Frequency	d/y	365	d	
EP	Indoor Air Exposure Period	y	5	d	
ATc	Indoor Air Averaging Time - Cancer	d	25550	c	
ATn	Indoor Air Averaging Time - Non-Cancer	d	1825	c	
C	Conversion Factor	ug/mg	1000		

Compound	EPC Indoor Air (mg/m3)		RfC (mg/m3)	URF 1/(ug/m3)	RAFic	ADE-c mg/m3	Riskinh	RAFinc	ADE-nc mg/m3	Hlinh	Risk (Indoor Air)	HI (Indoor Air)
Carbon tetrachloride	6.50E-04	ND	4.30E-01	1.50E-05	1	3.87E-05	5.80E-07	1	5.42E-04	1.26E-03	5.80E-07	1.26E-03
1,2-Dichloroethane	4.05E-04	ND	5.50E-02	2.60E-05	1	2.41E-05	6.27E-07	1	3.38E-04	6.14E-03	6.27E-07	6.14E-03
Tetrachloroethylene	3.80E-03		3.50E-02	5.71E-06	1	2.26E-04	1.29E-06	1	3.17E-03	9.05E-02	1.29E-06	9.05E-02
1,1,1-Trichloroethane	5.50E-04	ND	5.20E+00	NA	1	NA	NA	1	4.58E-04	8.81E-05	NA	8.81E-05
Trichloroethylene	5.50E-04	ND	3.50E-02	1.70E-06	1	3.27E-05	5.57E-08	1	4.58E-04	1.31E-02	5.57E-08	1.31E-02
Total							2.56E-06			1.11E-01	2.56E-06	1.11E-01

NA - Not available
NC - Not calculated
ND - Not detected

Appendix B
Exposure and Risk Estimates Associated With Inhalation of Volatile Compounds in Air
UniFirst
Tufts St.
Resident Adult
Indoor Air
23 Tufts St., Basement
08/03/2006

Receptor:	
Exposure Medium:	
Exposure Area:	
Duration:	

$$ADE_{inh} = \frac{C_{air} \times RAF_i \times ET \times EF \times EP}{24hr/d \times AT}$$

$$Risk = ADE_{inh} \times URF \times C$$

$$HI_{inh} = \frac{ADE_{inh}}{RfC}$$

Parameter	Definition	Units	Value	Source	Comment
ET	Indoor Air Exposure Time	h/d	4	d	
EF	Indoor Air Exposure Frequency	d/y	365	d	
EP	Indoor Air Exposure Period	y	5	d	
ATc	Indoor Air Averaging Time - Cancer	d	25550	c	
ATn	Indoor Air Averaging Time - Non-Cancer	d	1825	c	
C	Conversion Factor	ug/mg	1000		

Compound	EPC Indoor Air (mg/m3)		RfC (mg/m3)	URF 1/(ug/m3)	RAFic	ADE-c mg/m3	Riskinh	RAFinc	ADE-nc mg/m3	Hlinh	Risk (Indoor Air)	HI (Indoor Air)
Carbon tetrachloride	6.90E-04		4.30E-01	1.50E-05	1	8.21E-06	1.23E-07	1	1.15E-04	2.67E-04	1.23E-07	2.67E-04
1,2-Dichloroethane	4.05E-04	ND	5.50E-02	2.60E-05	1	4.82E-06	1.25E-07	1	6.75E-05	1.23E-03	1.25E-07	1.23E-03
Tetrachloroethylene	1.00E-02		3.50E-02	5.71E-06	1	1.19E-04	6.80E-07	1	1.67E-03	4.76E-02	6.80E-07	4.76E-02
1,1,1-Trichloroethane	6.00E-04		5.20E+00	NA	1	NA	NA	1	1.00E-04	1.92E-05	NA	1.92E-05
Trichloroethylene	5.50E-04	ND	3.50E-02	1.70E-06	1	6.55E-06	1.11E-08	1	9.17E-05	2.62E-03	1.11E-08	2.62E-03
Total							9.40E-07			5.18E-02	9.40E-07	5.18E-02

NA - Not available
NC - Not calculated
ND - Not detected

Appendix B
Exposure and Risk Estimates Associated With Inhalation of Volatile Compounds in Air
UniFirst
Tufts St.
Resident Adult
Indoor Air
23 Tufts St., 1st Floor
08/03/2006

Receptor:	
Exposure Medium:	
Exposure Area:	
Duration:	

$$ADE_{inh} = \frac{C_{air} \times RAF_i \times ET \times EF \times EP}{24hr/d \times AT}$$

$$Risk = ADE_{inh} \times URF \times C$$

$$HI_{inh} = \frac{ADE_{inh}}{RfC}$$

Parameter	Definition	Units	Value	Source	Comment
ET	Indoor Air Exposure Time	h/d	20	d	
EF	Indoor Air Exposure Frequency	d/y	365	d	
EP	Indoor Air Exposure Period	y	5	d	
ATc	Indoor Air Averaging Time - Cancer	d	25550	c	
ATn	Indoor Air Averaging Time - Non-Cancer	d	1825	c	
C	Conversion Factor	ug/mg	1000		

Compound	EPC Indoor Air (mg/m3)		RfC (mg/m3)	URF 1/(ug/m3)	RAFic	ADE-c mg/m3	Riskinh	RAFinc	ADE-nc mg/m3	HIinh	Risk (Indoor Air)	HI (Indoor Air)
Carbon tetrachloride	6.90E-04		4.30E-01	1.50E-05	1	4.11E-05	6.16E-07	1	5.75E-04	1.34E-03	6.16E-07	1.34E-03
1,2-Dichloroethane	4.05E-04	ND	5.50E-02	2.60E-05	1	2.41E-05	6.27E-07	1	3.38E-04	6.14E-03	6.27E-07	6.14E-03
Tetrachloroethylene	9.50E-03		3.50E-02	5.71E-06	1	5.65E-04	3.23E-06	1	7.92E-03	2.26E-01	3.23E-06	2.26E-01
1,1,1-Trichloroethane	5.50E-04	ND	5.20E+00	NA	1	NA	NA	1	4.58E-04	8.81E-05	NA	8.81E-05
Trichloroethylene	5.50E-04	ND	3.50E-02	1.70E-06	1	3.27E-05	5.57E-08	1	4.58E-04	1.31E-02	5.57E-08	1.31E-02
Total							4.53E-06			2.47E-01	4.53E-06	2.47E-01

NA - Not available
NC - Not calculated
ND - Not detected

Appendix B
Exposure and Risk Estimates Associated With Inhalation of Volatile Compounds in Air
UniFirst
Tufts St.
Resident Adult
Indoor Air
27 Tufts St., Basement
08/03/2006

Receptor:	
Exposure Medium:	
Exposure Area:	
Duration:	

$$ADE_{inh} = \frac{C_{air} \times RAF_i \times ET \times EF \times EP}{24hr/d \times AT}$$

$$Risk = ADE_{inh} \times URF \times C$$

$$HI_{inh} = \frac{ADE_{inh}}{RfC}$$

Parameter	Definition	Units	Value	Source	Comment
ET	Indoor Air Exposure Time	h/d	4	d	
EF	Indoor Air Exposure Frequency	d/y	365	d	
EP	Indoor Air Exposure Period	y	5	d	
ATc	Indoor Air Averaging Time - Cancer	d	25550	c	
ATn	Indoor Air Averaging Time - Non-Cancer	d	1825	c	
C	Conversion Factor	ug/mg	1000		

Compound	EPC Indoor Air (mg/m3)		RfC (mg/m3)	URF 1/(ug/m3)	RAFic	ADE-c mg/m3	Riskinh	RAFinc	ADE-nc mg/m3	HIinh	Risk (Indoor Air)	HI (Indoor Air)
Carbon tetrachloride	6.50E-04	ND	4.30E-01	1.50E-05	1	7.74E-06	1.16E-07	1	1.08E-04	2.52E-04	1.16E-07	2.52E-04
1,2-Dichloroethane	NA		5.50E-02	2.60E-05	1	#VALUE!	NA	1	#VALUE!	NA	NA	NA
Tetrachloroethylene	1.60E-03		3.50E-02	5.71E-06	1	1.90E-05	1.09E-07	1	2.67E-04	7.62E-03	1.09E-07	7.62E-03
1,1,1-Trichloroethane	5.50E-04	ND	5.20E+00	NA	1	NA	NA	1	9.17E-05	1.76E-05	NA	1.76E-05
Trichloroethylene	NA		3.50E-02	1.70E-06	1	#VALUE!	NA	1	#VALUE!	NA	NA	NA
Total							2.25E-07			7.89E-03	2.25E-07	7.89E-03

NA - Not available
NC - Not calculated
ND - Not detected

Appendix B
Exposure and Risk Estimates Associated With Inhalation of Volatile Compounds in Air
UniFirst
Tufts St.
Resident Adult
Indoor Air
27 Tufts St., 1st Floor
08/03/2006

Receptor:	
Exposure Medium:	
Exposure Area:	
Duration:	

Parameter	Definition	Units	Value	Source	Comment
ET	Indoor Air Exposure Time	h/d	20	d	
EF	Indoor Air Exposure Frequency	d/y	365	d	
EP	Indoor Air Exposure Period	y	5	d	
ATc	Indoor Air Averaging Time - Cancer	d	25550	c	
ATn	Indoor Air Averaging Time - Non-Cancer	d	1825	c	
C	Conversion Factor	ug/mg	1000		

$$ADE_{inh} = \frac{C_{air} \times RAF_i \times ET \times EF \times EP}{24hr/d \times AT}$$

$$Risk = ADE_{inh} \times URF \times C$$

$$HI_{inh} = \frac{ADE_{inh}}{RfC}$$

Compound	EPC Indoor Air (mg/m3)		RfC (mg/m3)	URF 1/(ug/m3)	RAFic	ADE-c mg/m3	Riskinh	RAFinc	ADE-nc mg/m3	HIinh	Risk (Indoor Air)	HI (Indoor Air)
Carbon tetrachloride	6.50E-04	ND	4.30E-01	1.50E-05	1	3.87E-05	5.80E-07	1	5.42E-04	1.26E-03	5.80E-07	1.26E-03
1,2-Dichloroethane	4.05E-04	ND	5.50E-02	2.60E-05	1	2.41E-05	6.27E-07	1	3.38E-04	6.14E-03	6.27E-07	6.14E-03
Tetrachloroethylene	8.10E-04		3.50E-02	5.71E-06	1	4.82E-05	2.76E-07	1	6.75E-04	1.93E-02	2.76E-07	1.93E-02
1,1,1-Trichloroethane	5.50E-04	ND	5.20E+00	NA	1	NA	NA	1	4.58E-04	8.81E-05	NA	8.81E-05
Trichloroethylene	5.50E-04	ND	3.50E-02	1.70E-06	1	3.27E-05	5.57E-08	1	4.58E-04	1.31E-02	5.57E-08	1.31E-02
Total							1.54E-06			3.99E-02	1.54E-06	3.99E-02

NA - Not available
NC - Not calculated
ND - Not detected

Appendix C
Exposure and Risk Estimates Associated With Inhalation of Volatile Compounds in Air
UniFirst
Tufts St.
Resident Adult
Indoor Air
9 Tufts St., Basement
07/24/2006

Receptor:	
Exposure Medium:	
Exposure Area:	
Duration:	

Parameter	Definition	Units	Value	Source	Comment
ET	Indoor Air Exposure Time	h/d	4	d	
EF	Indoor Air Exposure Frequency	d/y	365	d	
EP	Indoor Air Exposure Period	y	5	d	
ATc	Indoor Air Averaging Time - Cancer	d	25550	c	
ATn	Indoor Air Averaging Time - Non-Cancer	d	1825	c	
C	Conversion Factor	ug/mg	1000		

$$ADE_{inh} = \frac{C_{air} \times RAF_i \times ET \times EF \times EP}{24hr/d \times AT}$$

$$Risk = ADE_{inh} \times URF \times C$$

$$HI_{inh} = \frac{ADE_{inh}}{RfC}$$

Compound	EPC Indoor Air (mg/m3)		RfC (mg/m3)	URF 1/(ug/m3)	RAFic	ADE-c mg/m3	Riskinh	RAFinc	ADE-nc mg/m3	Hiinh	Risk (Indoor Air)	HI (Indoor Air)
Carbon tetrachloride	6.50E-04	ND	4.30E-01	1.50E-05	1	7.74E-06	1.16E-07	1	1.08E-04	2.52E-04	1.16E-07	2.52E-04
1,2-Dichloroethane	4.05E-04	ND	5.50E-02	2.60E-05	1	4.82E-06	1.25E-07	1	6.75E-05	1.23E-03	1.25E-07	1.23E-03
Tetrachloroethylene	3.10E-03		3.50E-02	5.71E-06	1	3.69E-05	2.11E-07	1	5.17E-04	1.48E-02	2.11E-07	1.48E-02
1,1,1-Trichloroethane	5.50E-04	ND	5.20E+00	NA	1	NA	NA	1	9.17E-05	1.76E-05	NA	1.76E-05
Trichloroethylene	5.50E-04	ND	3.50E-02	1.70E-06	1	6.55E-06	1.11E-08	1	9.17E-05	2.62E-03	1.11E-08	2.62E-03
Total							4.63E-07			1.89E-02	4.63E-07	1.89E-02

NA - Not available
NC - Not calculated
ND - Not detected

Appendix C
Exposure and Risk Estimates Associated With Inhalation of Volatile Compounds in Air
UniFirst
Tufts St.
Resident Adult
Indoor Air
9 Tufts St., 1st Floor Left
07/24/2006

Receptor:	
Exposure Medium:	
Exposure Area:	
Duration:	

Parameter	Definition	Units	Value	Source	Comment
ET	Indoor Air Exposure Time	h/d	20	d	
EF	Indoor Air Exposure Frequency	d/y	365	d	
EP	Indoor Air Exposure Period	y	5	d	
ATc	Indoor Air Averaging Time - Cancer	d	25550	c	
ATn	Indoor Air Averaging Time - Non-Cancer	d	1825	c	
C	Conversion Factor	ug/mg	1000		

$$ADE_{inh} = \frac{C_{air} \times RAF_i \times ET \times EF \times EP}{24hr/d \times AT}$$

$$Risk = ADE_{inh} \times URF \times C$$

$$HI_{inh} = \frac{ADE_{inh}}{RfC}$$

Compound	EPC Indoor Air (mg/m3)		RfC (mg/m3)	URF 1/(ug/m3)	RAFic	ADE-c mg/m3	Riskinh	RAFinc	ADE-nc mg/m3	Hlinh	Risk (Indoor Air)	HI (Indoor Air)
Carbon tetrachloride	6.50E-04	ND	4.30E-01	1.50E-05	1	3.87E-05	5.80E-07	1	5.42E-04	1.26E-03	5.80E-07	1.26E-03
1,2-Dichloroethane	4.05E-04	ND	5.50E-02	2.60E-05	1	2.41E-05	6.27E-07	1	3.38E-04	6.14E-03	6.27E-07	6.14E-03
Tetrachloroethylene	1.20E-03		3.50E-02	5.71E-06	1	7.14E-05	4.08E-07	1	1.00E-03	2.86E-02	4.08E-07	2.86E-02
1,1,1-Trichloroethane	5.50E-04	ND	5.20E+00	NA	1	NA	NA	1	4.58E-04	8.81E-05	NA	8.81E-05
Trichloroethylene	5.50E-04	ND	3.50E-02	1.70E-06	1	3.27E-05	5.57E-08	1	4.58E-04	1.31E-02	5.57E-08	1.31E-02
Total							1.67E-06			4.92E-02	1.67E-06	4.92E-02

NA - Not available
NC - Not calculated
ND - Not detected

Appendix C
Exposure and Risk Estimates Associated With Inhalation of Volatile Compounds in Air
UniFlrst
Tufts St.
Resident Adult
Indoor Air
9 Tufts St., 1st Floor Right
07/24/2006

Receptor:	
Exposure Medium:	
Exposure Area:	
Duration:	

Parameter	Definition	Units	Value	Source	Comment
ET	Indoor Air Exposure Time	h/d	20	d	
EF	Indoor Air Exposure Frequency	d/y	365	d	
EP	Indoor Air Exposure Period	y	5	d	
ATc	Indoor Air Averaging Time - Cancer	d	25550	c	
ATn	Indoor Air Averaging Time - Non-Cancer	d	1825	c	
C	Conversion Factor	ug/mg	1000		

$$ADE_{inh} = \frac{C_{air} \times RAF_i \times ET \times EF \times EP}{24hr/d \times AT}$$

$$Risk = ADE_{inh} \times URF \times C$$

$$HI_{inh} = \frac{ADE_{inh}}{RfC}$$

Compound	EPC Indoor Air (mg/m3)		RfC (mg/m3)	URF 1/(ug/m3)	RAFic	ADE-c mg/m3	Riskinh	RAFinc	ADE-nc mg/m3	HIinh	Risk (Indoor Air)	HI (Indoor Air)
Carbon tetrachloride	6.50E-04	ND	4.30E-01	1.50E-05	1	3.87E-05	5.80E-07	1	5.42E-04	1.26E-03	5.80E-07	1.26E-03
1,2-Dichloroethane	4.05E-04	ND	5.50E-02	2.60E-05	1	2.41E-05	6.27E-07	1	3.38E-04	6.14E-03	6.27E-07	6.14E-03
Tetrachloroethylene	2.00E-03		3.50E-02	5.71E-06	1	1.19E-04	6.80E-07	1	1.67E-03	4.76E-02	6.80E-07	4.76E-02
1,1,1-Trichloroethane	5.50E-04	ND	5.20E+00	NA	1	NA	NA	1	4.58E-04	8.81E-05	NA	8.81E-05
Trichloroethylene	5.50E-04	ND	3.50E-02	1.70E-06	1	3.27E-05	5.57E-08	1	4.58E-04	1.31E-02	5.57E-08	1.31E-02
Total							1.94E-06			6.82E-02	1.94E-06	6.82E-02

NA - Not available
NC - Not calculated
ND - Not detected

Appendix C
Exposure and Risk Estimates Associated With Inhalation of Volatile Compounds in Air
UniFirst
Tufts St
Resident Adult
Indoor Air
25 Tufts St., Basement
08/01/2006

Receptor:	
Exposure Medium:	
Exposure Area:	
Duration:	

Parameter	Definition	Units	Value	Source	Comment
ET	Indoor Air Exposure Time	h/d	4	d	
EF	Indoor Air Exposure Frequency	d/y	365	d	
EP	Indoor Air Exposure Period	y	5	d	
ATc	Indoor Air Averaging Time - Cancer	d	25550	c	
ATn	Indoor Air Averaging Time - Non-Cancer	d	1825	c	
C	Conversion Factor	ug/mg	1000		

$$ADE_{inh} = \frac{C_{air} \times RAF_i \times ET \times EF \times EP}{24hr/d \times AT}$$

$$Risk = ADE_{inh} \times URF \times C$$

$$HI_{inh} = \frac{ADE_{inh}}{RfC}$$

Compound	EPC Indoor Air (mg/m3)		RfC (mg/m3)	URF 1/(ug/m3)	RAFic	ADE-c mg/m3	Riskinh	RAFinc	ADE-nc mg/m3	HIinh	Risk (Indoor Air)	HI (Indoor Air)
Carbon tetrachloride	6.50E-04	ND	4.30E-01	1.50E-05	1	7.74E-06	1.16E-07	1	1.08E-04	2.52E-04	1.16E-07	2.52E-04
1,2-Dichloroethane	4.05E-04	ND	5.50E-02	2.60E-05	1	4.82E-06	1.25E-07	1	6.75E-05	1.23E-03	1.25E-07	1.23E-03
Tetrachloroethylene	3.90E-03		3.50E-02	5.71E-06	1	4.64E-05	2.65E-07	1	6.50E-04	1.86E-02	2.65E-07	1.86E-02
1,1,1-Trichloroethane	5.50E-04	ND	5.20E+00	NA	1	NA	NA	1	9.17E-05	1.76E-05	NA	1.76E-05
Trichloroethylene	5.50E-04	ND	3.50E-02	1.70E-06	1	6.55E-06	1.11E-08	1	9.17E-05	2.62E-03	1.11E-08	2.62E-03
Total							5.18E-07			2.27E-02	5.18E-07	2.27E-02

NA - Not available
NC - Not calculated
ND - Not detected

Appendix C
Exposure and Risk Estimates Associated With Inhalation of Volatile Compounds in Air
UniFirst
Tufts St.
Resident Adult
Indoor Air
25 Tufts St., 1st Floor
08/01/2006

Receptor:	
Exposure Medium:	
Exposure Area:	
Duration:	

Parameter	Definition	Units	Value	Source	Comment
ET	Indoor Air Exposure Time	h/d	20	d	
EF	Indoor Air Exposure Frequency	d/y	365	d	
EP	Indoor Air Exposure Period	y	5	d	
ATc	Indoor Air Averaging Time - Cancer	d	25550	c	
ATn	Indoor Air Averaging Time - Non-Cancer	d	1825	c	
C	Conversion Factor	ug/mg	1000		

$$ADE_{inh} = \frac{C_{air} \times RAF_i \times ET \times EF \times EP}{24hr/d \times AT}$$

$$Risk = ADE_{inh} \times URF \times C$$

$$HI_{inh} = \frac{ADE_{inh}}{RfC}$$

Compound	EPC Indoor Air (mg/m3)		RfC (mg/m3)	URF 1/(ug/m3)	RAFic	ADE-c mg/m3	Riskinh	RAFinc	ADE-nc mg/m3	Hiinh	Risk (Indoor Air)	HI (Indoor Air)
Carbon tetrachloride	6.50E-04	ND	4.30E-01	1.50E-05	1	3.87E-05	5.80E-07	1	5.42E-04	1.26E-03	5.80E-07	1.26E-03
1,2-Dichloroethane	4.05E-04	ND	5.50E-02	2.60E-05	1	2.41E-05	6.27E-07	1	3.38E-04	6.14E-03	6.27E-07	6.14E-03
Tetrachloroethylene	2.00E-03		3.50E-02	5.71E-06	1	1.19E-04	6.80E-07	1	1.67E-03	4.76E-02	6.80E-07	4.76E-02
1,1,1-Trichloroethane	5.50E-04	ND	5.20E+00	NA	1	NA	NA	1	4.58E-04	8.81E-05	NA	8.81E-05
Trichloroethylene	5.50E-04	ND	3.50E-02	1.70E-06	1	3.27E-05	5.57E-08	1	4.58E-04	1.31E-02	5.57E-08	1.31E-02
Total							1.94E-06			6.82E-02	1.94E-06	6.82E-02

NA - Not available
NC - Not calculated
ND - Not detected

Geotechnical
Environmental and
Water Resources
Engineering

www.geiconsultants.com